IN THE CLAIMS:

Please cancel claims 1-17, 20, 23-50, 52-60, 109-128, 130-131, 134-160, 163-172, and 221-227 and add new claims 228-311.

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228. In a digital communication system, a method for transmitting via a plurality of inputs to a channel, said method comprising:

providing a time domain substantially orthogonalizing procedure to divide said channel into input bins;

providing one or more spatial directions for communication defined by corresponding weightings among said channel inputs wherein each input bin has at least one associated spatial direction; and

transmitting said information in said subchannels by employing at least two independent parallel applications of said time domain substantially orthogonalizing procedure, said subchannels being defined by a combination of input bit and spatial direction.

229. The method of claim 228 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via exactly one channel input.

230. The method of claim 228 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via more than one channel input.

231. The method of claim 228 wherein said weightings are chosen based upon characterization of a desired signal subspace.

232. The method of claim 228 wherein transmitting comprises:

providing a group of input symbols wherein each input symbol corresponds to a particular input bin of said time domain substantially orthogonalizing procedure;

applying ones of said weightings corresponding to each of said input bins to each of said input symbols to develop for each of said input symbols a vector of spatially processed symbols, each element of said vector corresponding to a single channel input of said plurality of channel inputs;

applying said time domain substantially orthogonalizing procedure independently for each of said channel inputs to said spatially processed symbols; and

transmitting via said channel inputs responsive to results of said time domain substantially orthogonalizing procedure.

233. The method of claim 228 wherein transmitting comprises transmitting information in subchannels defined by said input bins and at least two spatial directions associated with each of said input bins, said spatial directions being chosen independently for each of said input bins.

234. The method of claim 233 wherein said at least two spatial directions are mutually orthogonal for each of said input bins.

235. The method of claim 233 wherein transmitting comprises:

providing a group of input symbols wherein each input symbol corresponds to a particular input bin of said time domain substantially orthogonalizing procedure and a particular one of said at least two spatial directions;

for each of said spatial directions applying one of said weightings to define contributions to each of said channel inputs;

for each channel input, independently applying said time domain substantially orthogonalizing procedure to results of applying said weightings; and

transmitting via said channel inputs responsive to results of applying said time domain substantially orthogonalizing procedure.

236. The method of claim 235 wherein said weightings are selected according to singular value decompositions of matrices characterizing communication via each input bin of said channel.

237. The method of claim 235 further comprising applying a coding procedure to develop said group of input symbols.

238. The method of claim 233 wherein said at least two spatial directions are not mutually orthogonal for each of said input bins.

239. The method of claim 238 wherein transmitting comprises:

coding said information to develop symbols corresponding to each of said subchannels, said coding being optimized to take advantage of multiple spatial directions;

applying said time domain substantially orthogonalizing procedure independently to symbols corresponding to each of said at least two spatial directions;

applying said weightings to results of said independent applications of said time domain substantially orthogonalizing procedure; and

transmitting via said channel inputs responsive to results of applying said weightings.

240. The method of claim 228 wherein said time domain substantially orthogonalizing procedure belongs to one of a group consisting of an inverse Fast Fourier Transform and a Fast Fourier Transform.

241. The method of claim 240 wherein said Fast Fourier Transform or said inverse Fast Fourier transform is followed by addition of a cyclic prefix.

242. The method of claim 228 wherein said channel comprises a wireless channel and said plurality of channel inputs are associated with a corresponding plurality of transmitter antenna elements.

243. The method of claim 242 wherein said plurality of transmitter antenna elements are co-located.

244. The method of claim 242 wherein said plurality of transmitter antenna elements are at disparate locations.

245. The method of claim 228 further comprising: allocating bit loading and power among said plurality of subchannels.

246. A transmitter system for transmitting via a plurality of inputs to a channel, said transmitter system comprising:

at least one processing element that applies a time domain substantially orthogonalizing procedure to divide said channel into input bins;

a spatial processor employing weightings among said channel inputs to define spatial directions wherein each input bin has at least one associated spatial direction; and

wherein said transmitter system transmits information in subchannels of said channel, each of said subchannels being defined by a combination of input bin and spatial direction, by employing said at least one processing element for at least two independent applications of said time domain substantially orthogonalizing procedure.

247. The transmitter system of claim 246 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via exactly one channel input.

248. The transmitter system of claim 246 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via more than one channel input.

249. The transmitter system of claim 246 wherein said weightings are chosen based upon characterization of a desired signal subspace.

250. The transmitter system of claim 246 comprising:

a system input that receives a group of input symbols wherein each input symbol corresponds to a particular input bin of said time domain substantially orthogonalizing procedure; and wherein

said spatial processor applies ones of said weightings corresponding to each of said input bins to each of said input symbols to develop for each of said input symbols a vector of spatially processed symbols, each element of said vector corresponding to a single channel input of said plurality of channel inputs; and wherein

said at least one processing element applies said time domain substantially orthogonalizing procedure independently for each of said channel inputs to said spatially processed symbols; and wherein

said transmitter system transmits via said channel inputs responsive to results of said time domain substantially orthogonalizing procedure.

251. The transmitter system of claim 246 wherein information is transmitted in subchannels defined by said input bins and at least two spatial directions associated with each of said input bins, said spatial directions being chosen independently for each of said input bins.

252. The transmitter system of claim 251 wherein said at least two spatial directions are mutually orthogonal for each of said input bins.

253. The transmitter system of claim 251 comprising:

a system input that receives a group of input symbols wherein each input symbol corresponds to a particular input bin of said time domain substantially orthogonalizing procedure and a particular one of said at least two spatial directions; and wherein

said spatial processor, for each of said spatial directions, applies one of said weightings to define contributions to each of said channel inputs; and wherein

said at least one processing element independently applies said time domain substantially orthogonalizing procedure to results of applying said weightings; and wherein

said transmitter system transmits via said channel inputs responsive to results of applying said time domain substantially orthogonalizing procedure.

254. The transmitter system of claim 253 wherein said weightings are selected according to singular value decompositions of matrices characterizing communication via each input bin of said channel.

255. The transmitter system of claim 253 further comprising an encoding system that applies a coding procedure to develop said group of input symbols.

256. The transmitter system of claim 251 wherein said at least two spatial directions are not mutually orthogonal for each of said input bins.

257. The transmitter system of claim 256 further comprising:

an encoding system that encodes said information to develop symbols corresponding to each of said subchannels, said coding being optimized to take advantage of multiple spatial directions; and wherein

said at least one processing element applies said time domain substantially orthogonalizing procedure independently to symbols corresponding to each of said at least two spatial directions; and wherein

said spatial processor applies said weightings to results of said independent applications of said time domain substantially orthogonalizing procedure; and wherein

said transmitter system transmits via said plurality of channel inputs responsive to results of applying said weightings.

258. The transmitter system of claim 257 wherein said weightings are selected so that there is a one to one association between channel inputs and spatial directions.

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259. The transmitter system of claim 246 wherein said time domain substantially orthogonalizing procedure belongs to one of a group consisting of an inverse Fast Fourier Transform and a Fast Fourier Transform.

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260. The transmitter system of claim 299 wherein said Fast Fourier Transform or said inverse Fast Fourier transform is followed by addition of a cyclic prefix.

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261. The transmitter system of claim B1 wherein said channel comprises a wireless channel and said plurality of channel inputs are associated with a corresponding plurality of transmitter antenna elements.

262. The transmitter system of claim 261 wherein said plurality of transmitter antenna elements are co-located.

263. The transmitter system of claim 261 wherein said plurality of transmitter antenna elements are co-located.

264. The transmitter system of claim 263 wherein said plurality of transmitter antenna elements are at disparate locations.

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265. The transmitter system of claim B1 further comprising:
a bit loading system that allocates bit loading and power among said plurality of subchannels.

Sub E1

266. In a digital communication system, a method for receiving via a plurality of outputs from a channel, said method comprising:

providing a time domain substantially orthogonalizing procedure to divide said channel into output bins;

providing one or more spatial directions for communication defined by corresponding weightings among said channel outputs wherein each output bin has at least one associated spatial direction; and

receiving information via subchannels of said channel by employing at least two independent parallel applications of said time domain substantially orthogonalizing procedure, each subchannel defined by a combination of output bin and spatial direction.

267. The method of claim 266 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via exactly one channel input.

268. The method of claim 266 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via more than one channel input.

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269. The method of claim 266 wherein said weightings are chosen based upon characterization of a desired signal subspace.

Sub E2

270. The method of claim 266 wherein receiving comprises:

receiving input time domain symbols via said channel outputs;

applying said substantially orthogonalizing procedure to said input time domain symbols independently for each of said channel outputs; and

applying ones of said weightings corresponding to each of said output bins to results of said substantially orthogonalizing procedure to obtain symbols transmitted via each of said subchannels.

271. The method of claim 266 wherein receiving comprises receiving information in subchannels defined by said output bins and at least two spatial directions associated with each of said output bins, said spatial directions being chosen independently for each of said output bins.

4 ~~272~~. The method of claim 3 ~~271~~ wherein said at least two spatial directions are mutually orthogonal for each of said output bins.

Sub F1

5 ~~273~~. The method of claim 3 ~~271~~ wherein receiving comprises:

receiving time domain symbols via said channel outputs;

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for each of said channel outputs, independently applying said time domain substantially orthogonalizing procedure to said received input time domain symbols; and

applying said weightings to results of said time domain substantially orthogonalizing procedure to obtain symbols transmitted via each of said subchannels.

6 ~~274~~. The method of claim 5 ~~273~~ wherein said weightings are selected according to singular value decompositions of matrices characterizing communication via each output bin of said channel.

7 ~~275~~. The method of claim 5 ~~273~~ further comprising applying a decoding procedure to said symbols transmitted via each of said subchannels.

8 ~~276~~. The method of claim 3 ~~271~~ wherein said at least two spatial directions are not mutually orthogonal for each of said output bins.

Sub F27

9 ~~277~~. The method of claim 8 ~~276~~ wherein receiving comprises:

receiving time domain symbols via said channel outputs;

for each of said channel outputs, applying said weightings to said time domain symbols to obtain results corresponding to each of said spatial directions;

applying said time domain substantially orthogonalizing procedure to said results independently for each of said spatial directions to obtain symbols transmitted via each of said subchannels; and

decoding said symbols transmitted via each of said subchannels according to a coding scheme optimized to take advantage of multiple spatial directions.

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10 ~~278~~. The method of claim 1 ~~266~~ wherein said time domain substantially orthogonalizing procedure belongs to one of a group consisting of a Fast Fourier Transform and an inverse Fast Fourier Transform.

11 ~~279~~. The method of claim 10 ~~278~~ wherein said Fast Fourier Transform or said inverse Fast Fourier Transform is preceded by removal of a cyclic prefix.

12 ~~280~~. The method of claim 1 ~~266~~ wherein said channel comprises a wireless channel and said plurality of channel outputs are associated with a corresponding plurality of receiver antenna elements.

13 ~~281~~. The method of claim 12 ~~280~~ wherein said plurality of receiver antenna elements are co-located.

14 ~~282~~. The method of claim 12 ~~280~~ wherein said plurality of receiver antenna elements are at disparate locations.

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283. The method of claim 266 further comprising:

receiving via a particular one of said channel outputs, at least ν frequency domain training symbols transmitted via a particular input to said channel in a single burst, ν being an extent in symbol periods of a duration of significant terms of an impulse response of a channel component coupling said particular channel input and said particular channel output;

applying said time domain substantially orthogonalizing procedure to said received at least ν training symbols to obtain a time domain response for said channel component; and

applying an inverse of said substantially orthogonalizing procedure to a zero-padded version of said time domain response to obtain a frequency response for said channel component.

Sub E3

284. A receiver system for receiving via a plurality of outputs from a channel, said receiver system comprising:

at least one processing element that a time domain substantially orthogonalizing procedure to divide said channel into output bins;

a spatial processor employing weightings among said channel outputs to define spatial directions wherein each output bin has at least one associated spatial direction; and

wherein said receiver system receives information via subchannels of said channel, by employing at least two independent parallel applications of said substantially orthogonalizing procedure by said at least one processing element, each of said subchannels being defined by a combination of output bin and spatial direction.

285. The receiver system of claim 284 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via exactly one channel output.

286. The method of claim 284 wherein said weightings define said one or more spatial directions so that each spatial direction corresponds to communication via more than one channel output.

287. The receiver system of claim 284 wherein said weightings are chosen based upon characterization of a desired signal subspace.

288. The receiver system of claim 284 further comprising:

a system input that receives input time domain symbols via said channel outputs; and wherein

said at least one processing element applies said substantially orthogonalizing procedure to said time domain input symbols independently for each of said channel outputs; and wherein

said spatial processor applies ones of said weightings corresponding to each of said output bins to results of said substantially orthogonalizing procedure to obtain symbols transmitted via each of said ~~subchannels.~~

18 ~~289.~~ The receiver system of claim 16 ~~284~~ wherein said receiver system receives information in subchannels defined by said output bins and at least two spatial directions associated with each of said output bins, each of said output bins having identical associated spatial directions.

19 ~~290.~~ The receiver system of claim 16 ~~284~~ wherein said receiver system receives information in subchannels defined by said output bins and at least two spatial directions associated with each of said output bins, said spatial directions being chosen independently for each of said output bins.

20 ~~291.~~ The receiver system of claim 19 ~~290~~ wherein said at least two spatial directions are mutually orthogonal for each of said output bins.

Sub A5

21 ~~292.~~ The receiver system of claim 19 ~~290~~ further comprising:

a system input that receives time domain symbols via said channel outputs; and wherein

said at least one processing element, for each of said channel outputs, independently applies said time domain substantially orthogonalizing procedure to said received input time domain symbols; and wherein

said spatial processor applies said weightings to results of said time domain substantially orthogonalizing procedure to obtain symbols transmitted via each of said subchannels.

22 ~~293.~~ The receiver system of claim 21 ~~292~~ wherein said weightings are selected according to singular value decompositions of matrices characterizing communication via each output bin of said channel.

23 ~~294.~~ The receiver system of claim 21 ~~292~~ further comprising a decoding system that applies a decoding procedure to said symbols transmitted via each of said subchannels.

24 ~~295.~~ The receiver system of claim 19 ~~290~~ wherein said at least two spatial directions are not mutually orthogonal for each of said output bins.

25 ~~296.~~ The receiver system of claim 24 ~~295~~ further comprising:

a system input that receives time domain symbols via said channel outputs; and wherein

said spatial processor, for each of said channel outputs, applies said weightings to said time domain symbols to obtain result symbols corresponding to each of said spatial directions; and wherein

said at least one processing element applies said time domain substantially orthogonalizing procedure to said result symbols independently for each of said spatial directions to obtain symbols transmitted via each of said subchannels; and wherein said receiver system further comprises:

a decoding system that decodes symbols transmitted via each of said subchannels according to a coding scheme optimized to take advantage of multiple spatial directions.

26 ~~297~~. The receiver system of claim 16 ~~284~~ wherein said time domain substantially orthogonalizing procedure belongs to one of a group consisting of a Fast Fourier Transform and an inverse Fast Fourier Transform.

27 ~~298~~. The receiver system of claim 26 ~~297~~ wherein said Fast Fourier Transform or said inverse Fast Fourier Transform is preceded by removal of a cyclic prefix.

28 ~~299~~. The receiver system of claim 16 ~~284~~ wherein said channel comprises a wireless channel and said plurality of channel outputs are associated with a corresponding plurality of receiver antenna elements.

29 ~~300~~. The receiver system of claim 28 ~~299~~ wherein said plurality of receiver antenna elements are co-located.

30 ~~301~~. The receiver system of claim 28 ~~299~~ wherein said plurality of receiver antenna elements are at disparate locations.

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Sub B7

302. The receiver system of claim 284 further comprising:

a channel estimation processor that receives via a particular one of said channel outputs, at least ν frequency domain training symbols transmitted via a particular input to said channel, ν being an extent in symbol periods of a duration of significant terms of an impulse response of channel component coupling said particular channel input and said particular channel, applies said time domain substantially orthogonalizing procedure to said received at least ν training symbols to obtain a time domain response for said channel component, and that applies an inverse of said substantially orthogonalizing procedure to a zero-padded version of said time domain response to obtain a frequency response for said channel ~~component.~~

303. A transmitter system for transmitting via a plurality of inputs to a channel, said transmitter system comprising:

at least one processing element ~~that~~ performs a time domain substantially orthogonalizing procedure to divide said channel into input bins;

an encoding system that applies an encoding scheme to information, said encoding scheme being optimized to take advantage of multiple spatial directions; and

wherein said transmitter system transmits information as encoded by said encoding system in subchannels of said channel, each of said subchannels being defined by a combination of input bin and spatial direction.

304. The transmitter system of claim 303 wherein each of said multiple spatial directions corresponds to transmission via a single channel input.

305. The transmitter system of claim 303 wherein each of said multiple spatial directions corresponds to a weighting among said channel inputs.

306. The transmitter system of claim 305 wherein said weighting is applied to a time domain signal.

307. A receiver system for receiving via a plurality of outputs from a channel, said receiver system comprising:

at least one processing element that performs a time domain substantially orthogonalizing procedure to divide said channel into output bins;

a decoding system that removes an encoding scheme from received information, said encoding scheme being optimized to take advantage of multiple spatial directions; and

wherein said receiver system receives said information in subchannels of said channel, each of said subchannels being defined by a combination of output bit and spatial direction.

308. The receiver system of claim 307 wherein each of said multiple spatial directions corresponds to reception via a single channel output.

309. The receiver system of claim 307 wherein each of said multiple spatial directions corresponds to a weighting among said channel outputs.

310. The receiver system of claim 309 wherein said weighting is applied to a time domain signal.

311. A receiver system that receives a burst of time domain symbols via an output of a channel, said receiver system comprising:

at least one processing element that performs a time domain substantially orthognalizing procedure on said burst of time domain symbols to recover a burst of frequency domain symbols; and

a channel estimation processor that receives at least ν training symbols belonging to said burst of frequency domain training symbols, ν being an extent in symbol periods of a duration of significant terms of an impulse response of said channel, applies said time domain substantially orthogonalizing